PHYSIOLOGICAL STUDIES OF PERSONS USING DIVINING RODS AS A DETECTION DEVICE

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THESIS

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ABSTRACT

An experiment was conducted in a laboratory where divining rods were used to detect an assortment of military weapons. Heart rate, skin resistance and skin temperature measurements were made to determine if these physiological parameters could be used to predict whether a target detection, false alarm, correct rejection or missed target would be reported. The resulting data indicates that when used under the conditons of this experiment, wire coat hanger divining rods perform as random detection devices. Multiple discriminant analysis was used to determine if the set of physiological parameters could discriminate among the possible outcomes that were reported. The set of parameters investigated did not discriminate.

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I. THE PROBLEM

During 1967 it was reported that the U.S. Marines were using divining rods in Viet Nam to locate underground structures and other objects. This generated interest at the U.S. Naval Postgraduate School and Lindsay (1967) directed an experiment in which subjects used L-shaped divining rods made from coat hangers to search for tunnels and anti-tank mines. The resulting data from that experiment showed that the divining rods performed as a random detection device. An interesting outcome of the experiment was the fact that all subjects answered yes to the following post-test question. "If you had no other detection equipment and were in a position to do so, would you use, or cause to be used, the coat hanger detection device as a tunnel detector in Viet Nam?" Many of the personnel involved in the experiment expressed a feeling, without explanation, that the divining rods gave an indication of target presence. Divining rods have been used for many years as a detection device yet there exists little or no scientific explanation for reported successes. Many proponents of the use of divining rods claim that success can be achieved by select persons only. An experiment was designed to be conducted in a laboratory environment to investigate certain physiological responses of individuals using rods as a detection device. Hopefully, differences in values of selected physiological parameters would permit classification by use

of these measurements and serve as a basis for further research. A device as simple and inexpensive as the L-shaped coat hanger divining rod could have wide spread military applications if they could be employed with a favorable degree of confidence.

II. THE LITERATURE

The verb "to divine" means to discover something obscure or in the future by mysterious or supernatural means. Tromp (1949) has defined the divining phenomena as the group of the most complex physico-chemical phenomena occurring in the world surrounding living matter and unconciously perceptible by nearly everybody (not only a favored few). According to Tromp, after being registered by our nervous systems they can be amplified and transformed into phenomena known in the ordinary perceptible world. That is, divining comprises those phenomena that usually need a biological amplifier for conscious observation with the ordinary sense organs.

The divining rod employed in this experiment is an outgrowth of similar devices used for water divining, better known as dowsing or rhabdomancy. Divining rods have been in use almost as long as civilization has existed. Certain passages of the Bible, "Hosea IV, 12", and "Ezekiel XXI, 21," allude to the use of such devices. The Journal of the British Society of Dowsers, March 1946 refers to a cast that was excavated by Baron Max Von Oppenheim in 1911 at Tell Halef Misopotamia, in layers containing objects from the Mitania-Hittite Kingdom, dated about 1300 B.C. The cast represents a priest who holds between his hands a tapering object which could be the oldest reproduction of a divining rod. Publications regarding rhabdomancy, from the Greek

words rhabdos meaning rod and manteia meaning divinination, first appeared about 1556 with Georgius Agricolas's De re metallica. A Benedictine monk of the 15th century, Basilius Valentinus, wrote of the use of the divining rod. Paracelsus, who died in 1541, in his publication gave an account of using divining rods.

Perhaps, the birthplace of the modern divining rod was in Germany. People believed that metallic ores attracted certain trees which drooped their branches over the place where ores were to be found. German miners who were imported to England during the 16th and 17th centuries probably introduced the divining rod there. The practice spread throughout Europe. At the end of the 17th century Jesuit Father Gaspard Schott advanced the theory that the movement of the rod was due to unconscious muscular action. About 1692 Pierre Lebrum suggested a theory of prior intention. Pierre Thouvenel developed the first electrical theory about 1780. These theories, though suggested, were not scientifically substantiated. Michel Eugene Chevreul made an investigation into the subject on behalf of the Academy of Science in 1854 and concluded that the whole phenomena was the result of involuntary muscular movements in the hand, induced by mental processes. Other studies by Latimer in 1875, Barrett in 1891 and Mager between 1909 and 1934 simply provided new theories or variations of other previously mentioned concepts. According to Tromp, the majority of modern dowsers are convinced that the turning of the rod is caused by a muscular action of the forearms.

Some investigations regarding physiological studies have been made. Schwarz (1963) conducted certain physiological studies on Henry Gross, the noted Maine dowser. He reported that a marked increase in pulse rate and a decrease in skin resistance were observed while Gross was in the process of detecting a target. Very little has been published recently to explain the phenomena of using divining rods as a detection device.

III. THE EXPERIMENT

Divining rods have been employed as a detection device by man for many years. However, observers of the phenomena remained divided in three general camps: the believers, the non-believers, and those who reserved opinion. The believers, many of whom are quite convinced, predicate their viewpoint on the simple axiom that the device works. The non-believers, on the other hand, argue that the phenomena can not be scientifically explained or validated. Those who reserve opinion, oscillate between moments of complete belief to unreserved doubt. Since there exists little or no evidence to give credence to any particular viewpoint, an endeavor to contribute information in the field was considered appropriate.

In late 1966, Louis J. Matacia (1968) proposed to the Armed Forces a method for locating underground tunnels, metallic objects or other subsurface enamolies. The need for such a device was quite apparent in Viet Nam. Arnett (1967) reported that the device was employed by the U.S. Marines at Khe Sanh, Viet Nam, and other news media reports indicated that some degree of success was achieved by the Marines with the device. Nevertheless, there remained, among the ranks of the users, the believers, the non-believers, and those who reserved opinion.

Discussions by the author with a Marine Combat Commander who had used the device generated an interest in trying to

explain the phenomena. It was felt that certain physiological parameters could be evaluated while an individual was engaged in searching for a target and these parameters might then be used to classify personnel according to their ability with the device. Initially, electroencephalographic (brain waves) and electromyographic (muscle waves) studies as well as measurement of skin resistance, skin temperature and heart rate were selected as parameters for investigation. Since the divining rod was to be employed in a dynamic mode, inclusion of brain waves and muscle waves as parameters of interest had to be abandoned because meaningful measurements could not be made on a person while walking. This experiment was therefore designed to determine if skin resistance, skin temperature and heart rate could be used as classification parameters for personnel into groups according to ability to use the divining rod as a detection device.

IV. METHOD

A. EQUIPMENT

Two divining rods were fabricated from ordinary wire coat hangers. Each rod, approximately 3/16^{ths} of an inch in diameter, was bent in the shape of an "L" with the larger side being 26 inches long. These specifications are the same as those suggested by Matacia (1968) to the U.S. Marine Corps.

The target to be detected using the rods was an assortment of Soviet and U.S. small arms. The six weapons used were the following: U.S. Rifle, Caliber 30, M1; U.S. Carbine, Caliber 30, M1; U.S.S.R. Rifle, Moissin-Nagant, M1891/30; U.S. Automatic Pistol, Caliber 45, M1911A1; U.S.S.R. Pistolet Tokarev Tulski, 7.62 mm; and U.S.S.R. Nagant Revolver, 7.62 mm. The combined weight of the six weapons was approximately thirty pounds. Two identical cardboard boxes, 36 in. X 22 in. X 12 in., were obtained. All weapons were wrapped in newspaper and sealed in one of the cartons. The other carton was sealed empty.

Skin resistance, heart rate and skin temperature were the parameters selected for investigation. To translate the physiological inputs detected by the skin electrodes (or thermistor in the case of skin temperature) into continuous graphical outputs, a six pen Edin Co. Oscillograph Recorder was used. The voltage inputs to recorder pens were products of locally designed circuitry incorporating the

electrodes and thermistor and Brush Electronics Co. Dual Channel D.C. Amplifiers. The latter provided a scale and sensitivity control for each oscillograph recorder pen.

Circuitry for skin temperature included a Wheatstone bridge (of which the thermistor was a component), whose output was channeled through an integrated circuit operational amplifier to the Brush amplifier. To measure skin resistance, a small voltage was first introduced across the body via the attached electrodes. For the initial body resistance of an individual, a potentiometer was employed to adjust a zero output so that all subsequent outputs reflected changes in body resistance. These voltages were multiplied by 1000 in an operational amplifier, from which the signal was fed into the Brush amplifier.

Field effect transistors, in a differential amplifier configuration, were utilized to effect noise cancellation and impedance matching during the detection of heart rate. The dual signal output of the differential amplifier was then amplified and joined as a single output by an integrated circuit operational amplifier, from which the signal was fed into the Brush amplifier.

B. SUBJECTS

Twenty subjects (Ss), students at the Naval Postgraduate School, Monterey, California, participated in the test. The Ss consisted of ten Army, five Marine, and five Naval officers. Seven of the Ss had some experience with the

device and the technique being tested. All Ss indicated that they had no firm convictions regarding the usefulness of divining rods as a detection device.

C. PROCEDURE

Initially all Ss were briefed on the purpose of the experiment and told that the electrodes attached to their bodies would cause no unusual sensations or pain. Three skin electrodes were used to detect the heartbeat of a S. One electrode was placed on the left upper quarter of the chest, another on the right lower quarter with the third (ground) electrode on the abdomen approximately four inches to the left of the navel. A thermistor, to measure skin temperature, was attached to the outside of the upper left arm. Two skin electrodes were employed to measure changes in skin resistance. One electrode was placed on the outside of the left wrist with the other placed adjacent to the ground electrode of the heart beat set of electrodes. All electrode leads and the thermistor wire were sufficient in length to permit a S to move about freely within twelve feet of the console utilized to translate the physiological inputs.

All Ss were instructed in the "Matacia Method" of employing the divining rods. One rod was held in each hand with the eight inch portion of the rod being held in the fist. The two rods were held side by side with the fist slightly relaxed and touching. The routine to be followed by each S was demonstrated to insure that all questions

were resolved before commencing a test run. A trial involved the S obtaining an initial standing position, at which time the rods were to be held chest high paralleling the floor and each other. The rods were to be held by the short side of the "L" in a manner so as to allow the long side of the "L" to swing in an arc while remaining horizontal. According to theory, if the rods either swing open or crossed while in the process of target searching then it was considered that the device had made a detection.

Each S was then instructed to walk, approximately six feet, toward a designated target area where either the carton containing the weapons or the empty carton was placed. The S would then stop and observe the action of the rods if any. At this point the rods were over the carton in the target area. If the rods either crossed or opened, the S reported that the target was present i.e., the carton in the target area was the one containing the weapons. The S then remained standing over the target area for approximately thirty seconds until told to return to the starting position and be seated. After the instructional trials, each S conducted twenty trials during his period of evaluation. The target, the collection of small arms in the carton, was presented during ten of the trials. On the other ten trials the empty carton was presented. A table of random numbers was used to determine the sequence of target presentation.

V. RESULTS

The responses made by the Ss in regard to target presence were recorded and compared to the state of nature that existed. The target was either present or not present. A detection system is considered effective if it furnishes a high probability, p_d, of detecting a target that is present and a low probability, p_f, of indicating a target is present when one is not. If $p_d = p_f$ the detection system is considered random and a guess without the aid of any device would produce similar results.

Each S executed 20 trials and the target was present only during ten of the trials. There existed four possible outcomes during each S's evaluation. If the target was present it could be reported (target detection) or not reported (missed target). If the target was not present it could be reported (false alarm) or not reported (correct rejection). Target detections and correct rejections are the desired outcomes of a detection system. False alarms and missed targets are considered undesireable outcomes. The hypothesis that it is equally likely to have between six and fifteen desired outcomes for each S could not be rejected using the Kolmogorov-Smirnov One-Sample Test.

During the experiment four hundred trials were executed. Of the 200 times that the target was present it was detected 93 times for an estimated $p_d = .465$. The target was reported present 85 times when it was not for an estimated

p_f = .425. Under the assumption that all Ss were alike in their performance, the hypothesis that the divining rods perform as a random detection system ($p_d = p_f$) in detecting the target consisting of small arms could not be rejected (Chi square = .856 with 1 d.f.).

During each trial of the experiment, three physiological measurements on each S were made and recorded. All measurements were made during a twenty second interval while the S stood adjacent to the target area. The measurements recorded were as follows: Skin resistance in ohms, skin temperature in degrees centigrade and heart rate in beats per minute. The arithmetic average, during each twenty second interval, was recorded for skin resistance and skin temperature. Thus a three dimensional vector of heart beat, skin resistance and skin temperature existed for each trial and the sector therefore could be categorized into one of four possible outcomes.

The multiple discriminant function was selected as the appropriate technique to analyze the data to determine if the physiological parameters would discriminate between the four possible outcomes. Even though the rods performed as a random detection system, it was possible that certain combinations of the physiological parameters existed such that they differed for target detections, false alarms, correct rejections and missed targets. Discriminant analysis, Tiedeman (1951), is designed to find out whether discrimination among groups is possible. If there exist

significant differences in the 3 dimensional vectors of physiological measurements between each group, then it is possible to classify into groups according to the values of these parameters. There were 93 target detections recorded and 85 false alarms. Consider plotting in 3 dimensional space all 93 vectors that were target detections and all 85 vectors that were flase alarms. If the points tend to occupy different regions of the 3 dimensional space, then classification by these three parameters is possible.

One of the first problems to resolve was deciding whether the means of the four groups for each of the variables differed significantly. The well-known analysis of variance provides our answer to this question. However, since the variables are likely to be highly correlated, they cannot be treated as independent. Perhaps only one of the variables contribute to discrimination among the groups while the other variables provide no means of discrimination when considered alone. Discriminant analysis provide a means of considering the entire constellation of points. One of the advantages of discriminant funtion analysis is that if the centroids of each group in the three dimensional space are all coincidental, then assignment to groups in terms of these variables is impossible. Rulon (1950) has termed this property of discriminant analysis the "fail safe property."

A computer program, BMD05M - Discriminant Analysis - Several Groups - Version of June 9, 1966 - Health Sciences Computing Facility, UCLA, was used to analyze the data. Each of the four possible outcomes, target detection, correct rejection, false alarm and missed target was considered as a group. If the variables, heart rate, skin resistance and skin temperature differed significantly among the groups, then they would serve as a means of classification to the particular group. That is, if there existed a set of physiological responses while a S was in the process of a target detection that was different from the set observed while making a false alarm, then it could be concluded that physiological changes existed that were associated with the outcomes. Using the computer program, it was not possible to classify into the groups mentioned by means of the variables selected. The hypothesis that the mean values are the same in all the groups for the three variables could not be rejected using the generalized Mahalenobis D square statistic.

VI. DISCUSSION AND CONCLUSIONS

Wire coat hangers were used as divining rods to serve as a detection device for an assortment of small arms weapons in a laboratory environment. The Ss who participated in the experiment did not claim to possess any unusual ability or skill with divining rods. All Ss reported, on at least some trials, that the divining rods either crossed or spread and indicated target presence accordingly. Twenty Ss executed twenty trials each and the resulting data indicated that the rods performed in a random manner. Lindsay (1967) established that the wire coat hanger divining rods performed as a random detection system while being used to detect tunnels and buried anti-tank mines in a field environment. The value of divining rods as a detection device can not be discounted entirely. A number of persons claim to possess superior abilities in detecting water and underground objects. Scientific evaluation of these individuals and their performances would be appropriate to either explain the phenomena or establish it to be a myth. All Ss made between six and fifteen correct responses out of a possible twenty. Two Ss were at each extreme with the remainder uniformly distributed within this range. It appeared that no particular S possessed superior ability. Even though the selection of Ss from members of the Armed Forces was not random, the wire coat hanger divining rods

can not be used by a normal person and obtain other than random results.

The physiological measurements, heart rate, skin resistance and skin temperature, observed during trials did not vary significantly depending upon the outcome of a particular trial. Most Ss maintained a relatively constant skin temperature from trial to trial. Heart rate varied somewhat while skin resistance measurements fluctuated substantially with many Ss. However, it could not be established that the physiological measurements discriminated among the possible outcomes (target detection, etc.) of a particular trial.

With advanced instrumentation, electromyography studies could be undertaken. The resources available precluded conducting measurements of muscle waves while engaged in evaluating a S in a dynamic mode. Initially, of all physiological measurements considered, this was thought to be the one that would be the best discriminator. Fabricating instrumentation and developing a technique to investigate this parameter might be of interest and contribute to the understanding of the divining rod phenomena.

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13 ABSTRACT

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